DIVISION OF ENVIRONMENTAL HEALTH SERVICES, ALBERTA DEPARTMENT OF HEALTH. HON. J. D. HENDERSON, MINISTER; DR. P. B. ROSE, DEPUTY MINISTER

ALBERTA

POLLUTION CONTROL

FOREWORD

This booklet has been prepared to summarize the work being carried out by the Division of Environmental Health Services, in conjunction with the Provincial Board of Health, to control possible pollution of air and water throughout Alberta.

The current problems or pollution aspects which require attention may well not be the important ones in a few years and similarly control programs in Alberta will have to change to keep pace with the changing times. Readers of this booklet are asked to compare the problems as they see them with the work described, and if they feel that some aspects need more attention, please write and put forth your views.

Alberta is the place of home, work and recreation for over a million and a half persons. Many of its natural assets could be impaired or even spoiled if their values aren't appreciated and maintained at a good quality level. The prevention of adverse effects of pollution on the health and well-being of people is, of course, at the top of the list of priorities.

H. L. Hogge, Director,
Division of
Environmental Health Services,
Alberta Department of Health,
January, 1970.

THE PROGRAM

During the past two decades, Alberta has experienced a growth which, by its nature, has created a great awareness of the need to watch pollution of the air and water. This growth has been marked by urbanization, industrialization and resource development in quite a concentrated manner. There has been a drastic move from rural to urban areas (Graph I), and the development of business, commerce and industry in cities and towns has fostered a very rapid growth, especially in larger centres (Graph II, Tables 1, 2, 3, 4).

When the need for pollution control became apparent, water seemed to be first in priority, because of the readily visible aspects of water pollution and because Alberta's rivers flow into Saskatchewan, which also has a need to use the waters in the rivers.

The first specific work on water pollution assessment and control was started in 1950. The program on air pollution control was inaugurated in 1957 and has been developing continuously since then, with provincial regulations being set out in 1961.

The Public Health Act, and regulations made under authority of the Act, set out the pollution control program. Briefly, no one is allowed to release materials which

ELECTRICAL ENERGY GENERATED
(Thousands of KW hours)

1921	115,580
1931	206,779
1941	322,688
1951	1,036,636
1961	3,794,730
1967	6,803,301

Table 1

AGRICULTURAL PRODUCTS SOLD — GROSS VALUE IN $

1906	16,428,205
1916	207,838,297
1926	263,913,260
1936	157,332,520
1946	420,000,000
1956	694,646,000
1967	1,006,833,000

Table 2

MANUFACTURING — GROSS VALUE OF PRODUCTION IN $

1905	4,979,932
1915	29,416,221
1926	83,425,631
1936	74,052,010
1946	257,031,867
1956	703,188,739
1968	1,527,200,000

Table 3

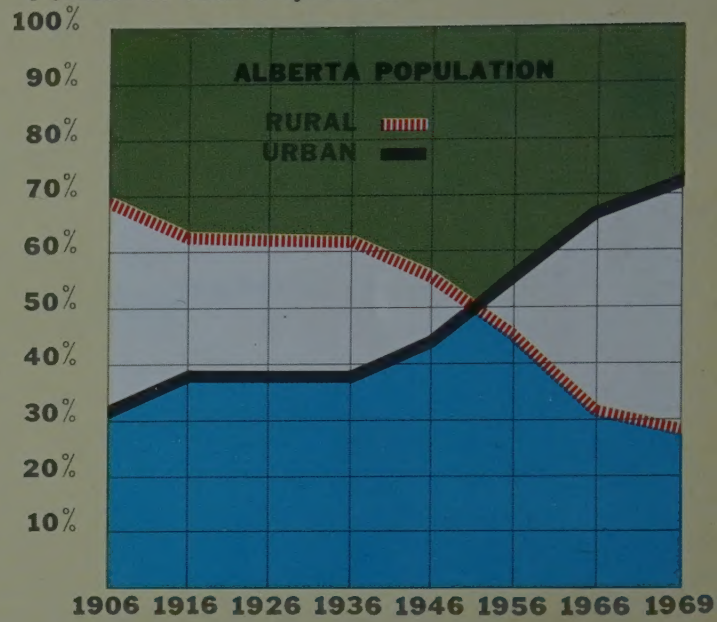
MOTOR VEHICLE REGISTRATION

1911	1,631
1921	39,852
1931	94,642
1941	126,127
1951	259,841
1961	509,298
1968	703,151

Table 4

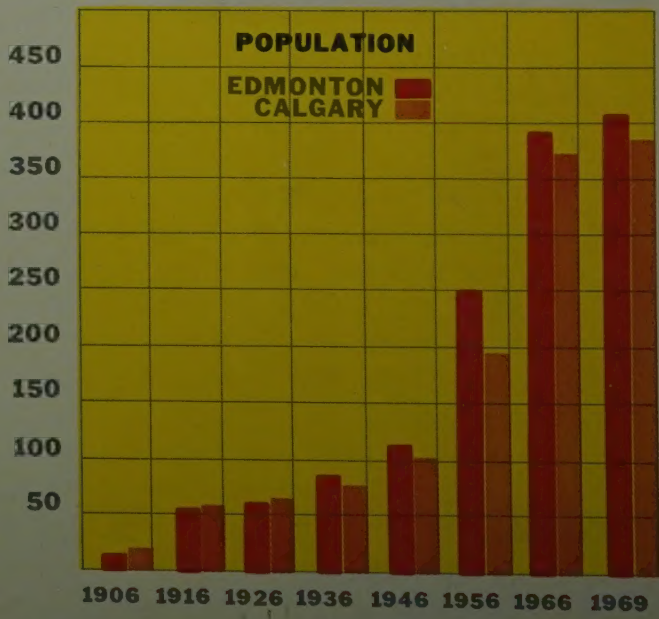
Graph 1

Percent of Total Population



Graph 2

Population in Thousands



might create pollution of air or water without first having obtained written approval from the Provincial Board of Health. Written approval must also be obtained for the construction of waterworks, sewerage, and solid refuse disposal systems. Needless to say, approvals will not be given unless suitable and adequate measures are included to avoid pollution of the environment. The Division of Environmental Health Services is the administrative unit which assists the Provincial Board of Health in administering this program of pollution control.

Approval to release waste material is followed up by the Division to see that conditions of the approval are adhered to and that the effect on the environment is not more critical than was anticipated at the time of approval.

The Division investigates complaints about pollution, and if the complaint involves the interest of other government departments, they are contacted and in many cases joint investigations are carried out.

The Division and Provincial Board of Health maintains an active liaison with other government departments and agencies involved in the control of pollution within their jurisdiction. These include the Oil and Gas Conservation Board, the Department of Agriculture, the Department of Mines and Minerals and the Department of Lands and Forests.

The subject of pollution is of immediate interest to a number of municipal and association groups because of direct involvement or direct interest in the possible adverse effects of pollution. Recognizing this, the Government of Alberta set up the Alberta Advisory Committee on Pollution Control in 1967, with the Minister of Health as Chairman. This committee is expected to critically review pollution problems and control programs and to make recommendations to the government through the Minister of Health. The membership of the Committee now numbers 110 and includes representatives from 13 provincial government departments, four federal government departments and 27 municipal, university and association groups, including industry. The committee held annual meetings in 1967, 1968 and 1969. The subject of pollution is subdivided into 14 specific areas and each is considered in greater detail by a subcommittee of the main committee.

Subcommittees meet during the year to draw up a presentation including suggestions and recommendations which is then presented to the main Committee.

The Advisory Committee represents in a very real way the opinion of a substantial group of Albertans as they are all representatives of associations, municipalities, universities, and departments of both the federal and provincial governments. They are, therefore, able to indicate the type of pollution control which is desired by the people of Alberta.

Traditionally, the emphasis of pollution control work has been the preservation of the usefulness of both air and water to other persons. Current thought classifies the environment as an integral part of living, work and recreation, and thus broader aspects of pollution have to be recognized. These include the health and well-being of people; the use and enjoyment of air, water, soil and property; the production of safe food, including vegetables and farm crops and livestock, and the prevention of progressive accumulation of toxic or noxious substances in the environment or biological species.

The Division of Environmental Health Services is organized into six different sections, and each section has a specific role in the implementation of the pollution control programs of the Department of Health. The type and scope of the operations currently being carried out by the sections is presented in this booklet.

WATER POLLUTION CONTROL

Water is essential to life, and without it no man, animal, fish or plant could survive. Seventy per cent of the human body's weight is water, and to replenish this supply a human must drink five to six pints of water daily. Without this, the body cannot continue to function.

It is difficult to think of any item used by man which is not dependent, at some stage of its development or manufacture, on water. So it becomes readily apparent that the water we have must be maintained at or restored to a state where it is fit for use by all forms of life.

No water is absolutely pure. Newly precipitated vapors in the upper atmosphere contain dissolved atmospheric gases, and during their passage to the ground gather bacteria, dust and spores.

When the water reaches the earth's surface, it may dissolve organic residues of plant and animal life, or carry these into streams. All these materials, although from natural sources, are foreign to water itself, and even though they are unobjectionable, they constitute pollution in a strict sense. Yet these "pollutants" are also the beginning of natural aquatic life. The organic material in the water provides the nutrient basis for the development of bacteria and microscopic plant and animal

Water samples are obtained from rivers and streams and analyzed by the EHS laboratory to establish the quality of water throughout the province.

life which in turn is food for successive life stages: worms, insect larvae, and on through forms of increasing complexity to major fish life of streams, rivers and lakes which provides food for man.

Pollution, then, is a relative term, commonly applied when water quality is downgraded by sewage or other waste material to the point where it adversely affects water used for domestic, industrial, agricultural, recreational and other beneficial purposes.

The expanding population and industrial growth in Alberta over the past 20 years has resulted in a high demand for suitable water supplies both for human consumption and for the agricultural and manufacturing industries. At the same time, the demand for water systems as a carrier of waste material has also greatly increased. Because of the apparent abundance of water in the province, there has been a tendency to ignore or forget that there is a limit to the amount of waste which any water course can absorb.

There can be no suggestion, of course, that Alberta's rivers should not be used to transport waste—water is an efficient and economical carrier of undesirable materials. Because streams self-purify

Top: *Waste water from an industrial plant is checked before it is discharged to a river.* Bottom: *This robot water quality monitor is set up in a trailer near a river to measure five water quality constituents.*

themselves, they are capable of absorbing many kinds of pollutants. But there is a limit to this absorbing capacity. It therefore becomes necessary to restrict the discharge of wastes into streams to a specified amount and specified characteristics. Thus, Alberta has developed standards for the quality of streams receiving wastes, and has placed restrictions on the disposal of sewage and industrial wastes. It is recognized, though, that the prohibition of all waste products from streams is as impractical and undesirable as is the excessive use or gross pollution of our waters.

Probably the most important factor in determining the health of any river is the amount of dissolved oxygen present: this has been extensively used as a measure of the pollution which has occurred in the stream.

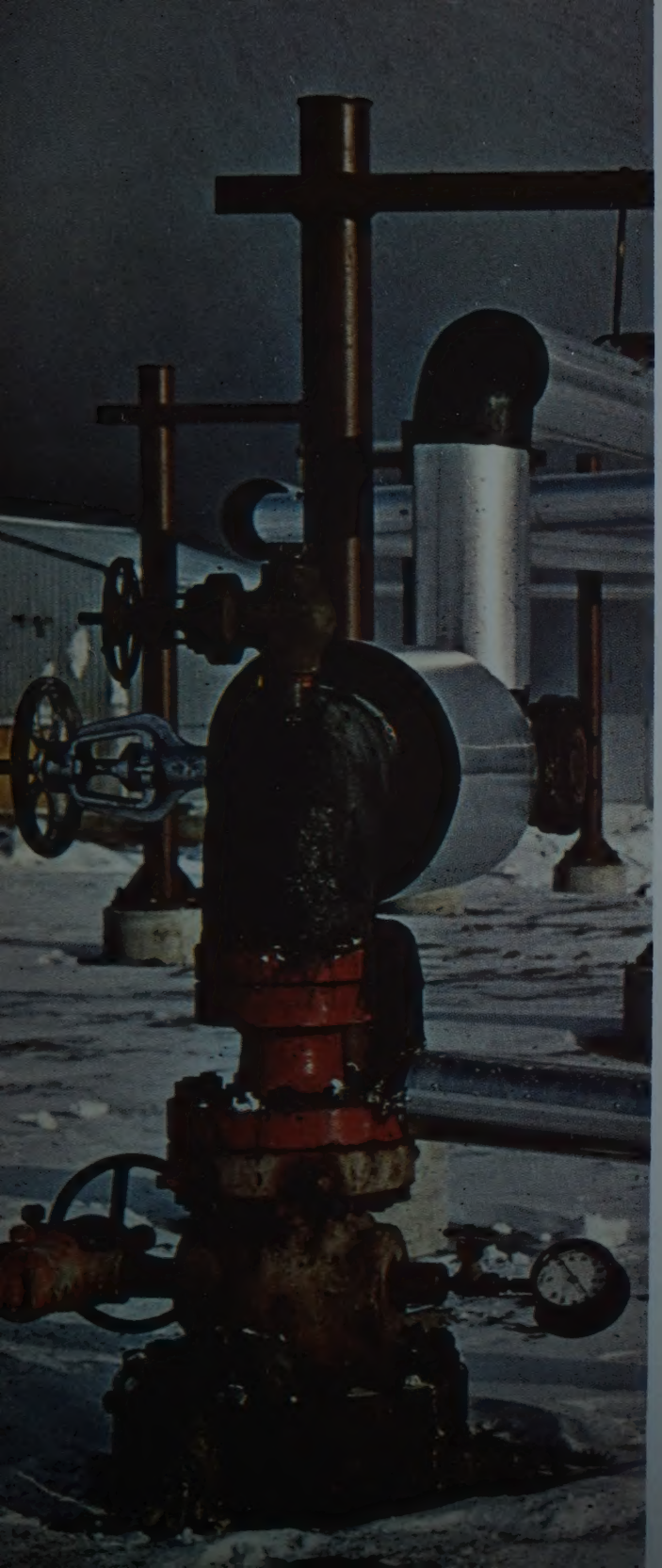
Waste released into a stream creates biological activity. This activity exerts a demand for oxygen in the water, and when this is not present the wastes are not broken down. Since ice separates the water from the atmosphere from four to five months of the year, it becomes critical to control and maintain proper oxygen content in the river to avoid adverse pollution effects during the winter months.

Rated among the greatest contributors to water pollution are phenolic wastes, petroleum oil and nutrients.

Phenolic wastes are the result of wood distillation, oil refining, production of chemicals, refuse of humans and animals and decaying of vegetation. These wastes, when present at a concentration of only five parts per billion by weight, create strong medicinal odors.

Oily substances create tastes and odors in water long before they are visible as a film on the surface, and long before they become a health hazard. Tastes and odors are also caused by the growth of algae and aquatic plants in both flowing and impounded water. Plant growth requires nitrogen and phosphorous, enough of which is found in natural water. When effluent high in these nutrients is discharged into a stream, excessive growth occurs.

Water may also be polluted by compounds never found in natural water, or which do not exist in nature, such as toxic metals and exotic organic or inorganic chemicals. Waste discharges with high temperature, color, odor, acid or alkaline content are likewise a contributor to pollution. In agriculture, pollution may



Deep well disposal is used to inject obnoxious materials into underground formations over 4,000 feet below the surface of the earth.

result from insecticides, fertilizers, and herbicides, as well as silt washed from soil by rain or floods, especially in areas where too many trees have been cut.

The assessment and control of water pollution is a task that falls to the Water Pollution Control Section. A regular system of lake and stream water testing is undertaken by Section crews, who collect samples for laboratory evaluation. Much of the testing is done during the winter months when ice cover and a reduced flow volume accentuates any pollution problem which may exist. These field surveys ensure that the water throughout the province meets the quality criteria established in 1969 by the Provincial Board of Health.

By sampling the waste being discharged, as well as the river above the point of discharge and the river downstream, the effects of a waste water on a receiving stream are determined. This data is then used to draw up schedules showing the acceptability of pollutants to individual streams and bodies of water, as well as to an entire river basin. Under these schedules, a level of absorption is established beyond which the water becomes polluted to an extent harmful to plant, animal or human life.

A robot water quality monitor has been placed in service to complement manual sampling surveys, and other electronic analyzers are used for sampling under adverse winter conditions.

Although the water pollution control program is at its peak during the winter months, all seasons present specific problems. Industries which store wastes over the winter period are anxious to dispose of the accumulated material early in the spring. During the early summer months irrigation districts treat their canals to control weeds. Some industries work only during certain seasons, and present special problems at that time.

To prevent new sources of water pollution from coming into existence, the Water Pollution Control Section reviews plans for proposed industrial plants with respect to potential water pollution and proposed controls. Plans for treatment of industrial wastes must receive Provincial Board of Health approval before any wastes are discharged into a water course.

Prevention of water pollution is achieved by purifying waste waters to conform to Provincial Board of Health standards before discharge. Pollution may also be prevented by developing alternative waste water disposal methods, such

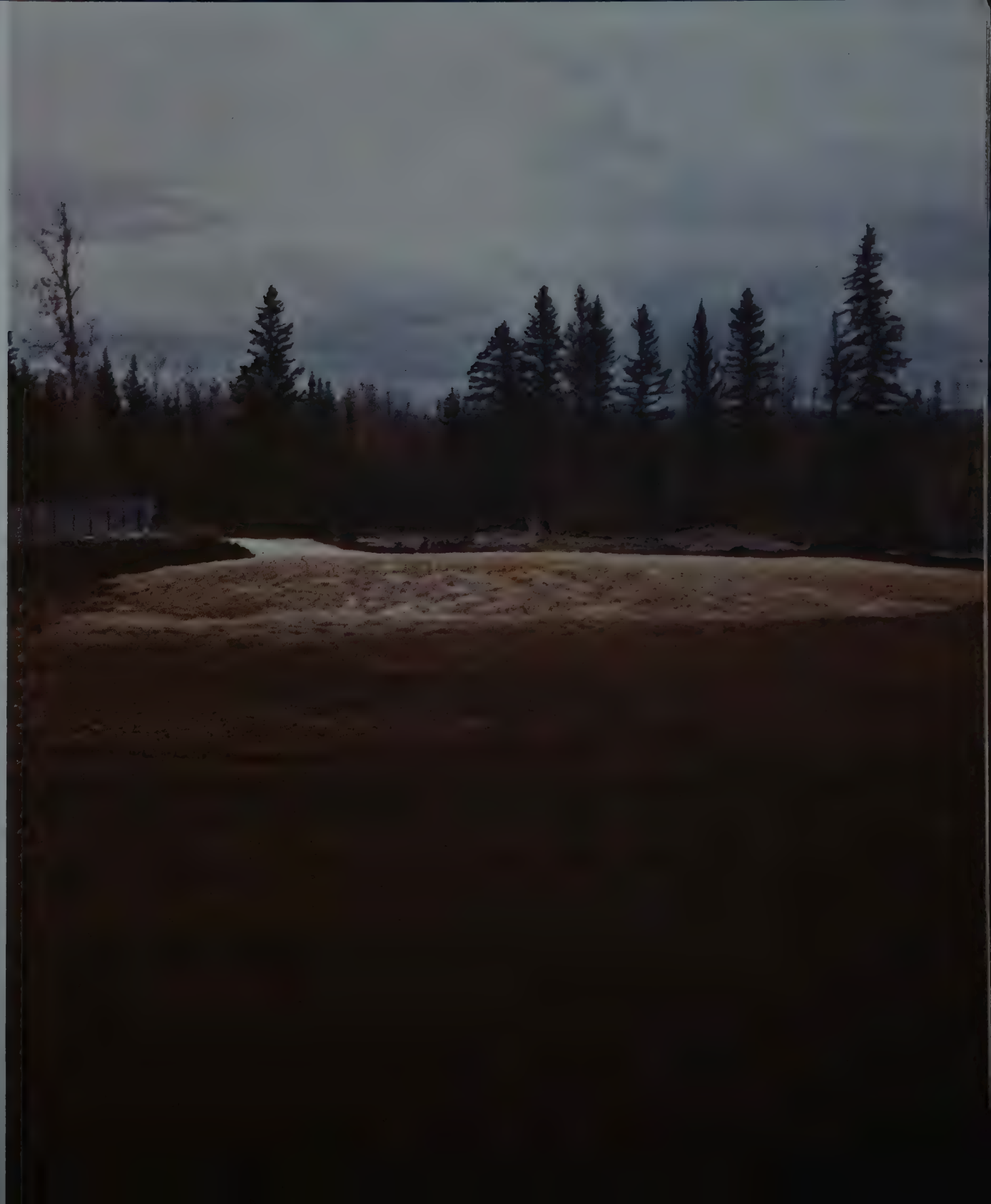
Part of a waste water treatment system for a pulp mill, this pond retains foam before the waste is discharged to a river.

as injection of toxic waste material into deep underground wells. This method is used by some of the large chemical plants and petroleum refineries in Alberta.

With an expanding population, Alberta's water resources will have to be tapped at a rapidly increasing rate to provide usable water at a low cost. The strain upon the natural capabilities of the province undoubtedly will increase, eventually reaching the point where there would be no more undeveloped fresh water within our land boundaries.

The basic solution to these problems must be found in a more efficient utilization of the existing water resources through multiple re-use. Usage of the waters receiving waste material must be planned so that orderly growth and expansion can take place. A constant review of the uses of the surface waters and the quality and nature of the waste carried in them must be maintained to ensure that, should there be any changes, no injury to life and property results.

Increased use of rivers by municipalities, industries and private citizens has necessitated an ever-expanded program of pollution control dedicated to maintaining Alberta's rivers in a suitable condition for use by future generations.



AIR POLLUTION CONTROL

Air is, literally, the breath of life. Without it, nothing can survive. The pollution of air is not a new phenomenon, and undoubtedly originated when man first lit a fire. It was recognized as a problem during the Roman times and by the 18th century was prevalent in most major cities of Europe and North America.

Air pollution is normally associated with some activity of man, but man is not solely responsible. The haze normally seen in the country-side is associated with plant life. Wind-borne dusts, salt sprays and pollens are also natural contaminants of the atmosphere.

Practically no air is absolutely pure, but when the concentration of contaminants interferes with the well-being of plant, animal or human life, a pollution problem may arise.

Air pollution may be caused by many substances coming from many sources: automobile exhaust pipes, carburetors, home furnaces, incinerators, burning of leaves, construction, demolition, oil refineries, steel mills, pulp and paper plants and almost every other kind of industry.

Normally, the atmosphere can absorb many pollutants: they are diluted in the air; rain, snow, and dew help remove the dust, smoke and gaseous pollutants; and vegetation, soil and water absorb gases in the air as part of the natural cleaning process. If this happens as fast as pollutants are released, then the consequences are negligible. However, sometimes unusual weather conditions interfere with the normal process and a temporary pollution problem arises due to stagnant air or limited ventilation.

Air pollution due to smoke is the most common problem faced by cities and is the most easily recognized since it contributes most to limiting visibility. It is the result of incomplete combustion, and consists of minute particles of carbon which remain suspended in air until removed by precipitation or gravitation.

Dusts are another pollutant which limits visibility. They are solid particles which are produced by combustion and such processes as crushing, grinding and demolition. In industrial areas, it may cause respiratory diseases and may contain poisonous substances such as lead.

Air pollution damages property chiefly by causing corrosion of metals, by causing rubber to crack and by causing painted surfaces to deteriorate. The offending pollutant in metal corrosion is sulphur dioxide, which reacts with oxygen and water in the atmosphere to form an acid which attacks metals. In the case of paint deterioration, hydrogen sulphide is

the offender. In Alberta, a large percentage of these two gases originate with the petroleum industry.

The same two gases are also the most common air contaminants poisonous to vegetation. The damage varies, but the most common sign is the disappearance of the green color from plants.

Air pollutants may cause eye, nose and throat irritations, and subject persons to offensive odors. Headaches and allergy reactions may also result. Secondary effects of air pollution include air traffic delays caused by poor visibility, and reduction of land values near sources of air pollution.

The rapid expansion of urban areas, and the development of more industry, continually creates more sources of air pollution. These sources may affect only the adjacent area, or, combined with other sources, blanket an entire metropolitan area.

During the past few years nearly every large urban area in the world has experienced a drastic increase in the pollution of its atmosphere. As the discomforts of air pollution become more noticeable, the public demand for rigid control increases steadily.

Legislation for the control of air pollution in Alberta has developed as the

Top: *This waste wood burner at a plywood mill emitted plumes of smoke, adding to air pollution.* Bottom: *A new incinerator and stack, to the right of the old burner, eliminated this problem.*

need, or anticipated need, arose. The first specific regulations for the control of air pollution came into force September 15, 1961, although legislation had been passed as early as 1945 and 1946 to deal with specific complaints. In 1955, the penalty for non-compliance with a Provincial Board of Health order or an air pollution control regulation was set at the rate of up to $500 per day.

The regulations set out in 1961 require the submission of plans and specifications of all new industries and incinerators to the Provincial Board of Health for approval. At that time, existing air pollution sources were given five years in which to arrange compliance with the regulations.

Standards were established, and the allowable levels of smoke, particles, odorous material and toxic or noxious material set out. The Board may, however, vary specific limits of particles and smoke where it is satisfied this would be in the public interest.

The method of applying for air pollution control approval varies from industry to industry, but all applications must include information on the manufacturing process and materials, along with information on the volume, temperature, veloc-

Top: *Black coal dust rises from a coal drying operation.* Bottom: *This problem was solved by installing dust collection equipment.*

ity, contaminant concentration and stack height at each point of emission.

After approval is given, follow-ups are made through periodic measurement of the emission (in the case of larger sources this is once a year), and by monitoring the area for the specific contaminants involved.

A number of larger gas processing and sulphur recovery plants in the province carry out their own program of area monitoring and emission evaluation and forward regular reports to the Department of Health.

Regardless of the air pollution problem to be attacked, whether it be a community-wide problem or merely a single-source problem, there are two fundamental approaches: control of the pollutant at the source so that excessive amounts are not emitted to the atmosphere in the first place, or natural dilution of the pollutant, after it has been emitted, to such a concentration that man, animals, vegetation and materials will not be harmed.

Control of pollutants at the source may mean extra effort for industry. Industries already in operation may need to make raw material or operational changes; modify or replace process equipment; adopt an alternate method to produce the same product with fewer

Water vapor, visible during the winter season, may adversely affect visibility under certain weather conditions.

atmospheric wastes, or operate existing equipment more efficiently.

For industries developing entirely new products or processes, it is important to think about pollution problems in the research laboratory. With such an approach it may be found that other lines of research differing from those being followed may prove more promising; or, by developing a more expensive process, but one which reduces or eliminates the need for air pollution control equipment, it may be found that the overall production costs will be cheaper.

If the pollutant can not be prevented from forming, and its emission would be excessive, equipment which destroys, alters or traps the pollutant will be required.

Although the best method of control confines the contaminant at its source, the method of natural dilution of the pollutant in the atmosphere before it can reach the receptor in harmful concentrations is also used. This natural dilution can be accomplished by the use of tall stacks, community planning in which zoning the use of air is the primary object, or restricting plant operations under adverse weather conditions.

The responsibility of the individual in air pollution control is not as remote as

Black smoke rises from a hydrocarbon gas flare. Smokeless flares can eliminate this unsightly air pollutant.

it may seem at first glance. Although the industrial complex is an obvious source, the individual in his every day living does contribute a significant amount of pollutants to the atmosphere: from one-third to as much as three-quarters of the total emissions. This includes pollution from the operation of motor vehicles, domestic heating, and the disposal of solid refuse. The latter in itself varies to a great extent depending on the disposal methods.

The individual can greatly assist in total pollution control by merely looking after his own contributions. This would include keeping any motors, whether in cars, lawnmowers or snowmobiles, in top operating condition. Domestic heating systems should be operated properly, and households should avoid open burning of solid refuse.

Individuals can also help by bringing to the attention of the officials any sources of pollution that could be causing local problems which are not always obvious when inspections are made.

In order to regulate and assess air pollution in the province, the Air Pollution Control Section carries out a number of surveys, inspections and research programs.

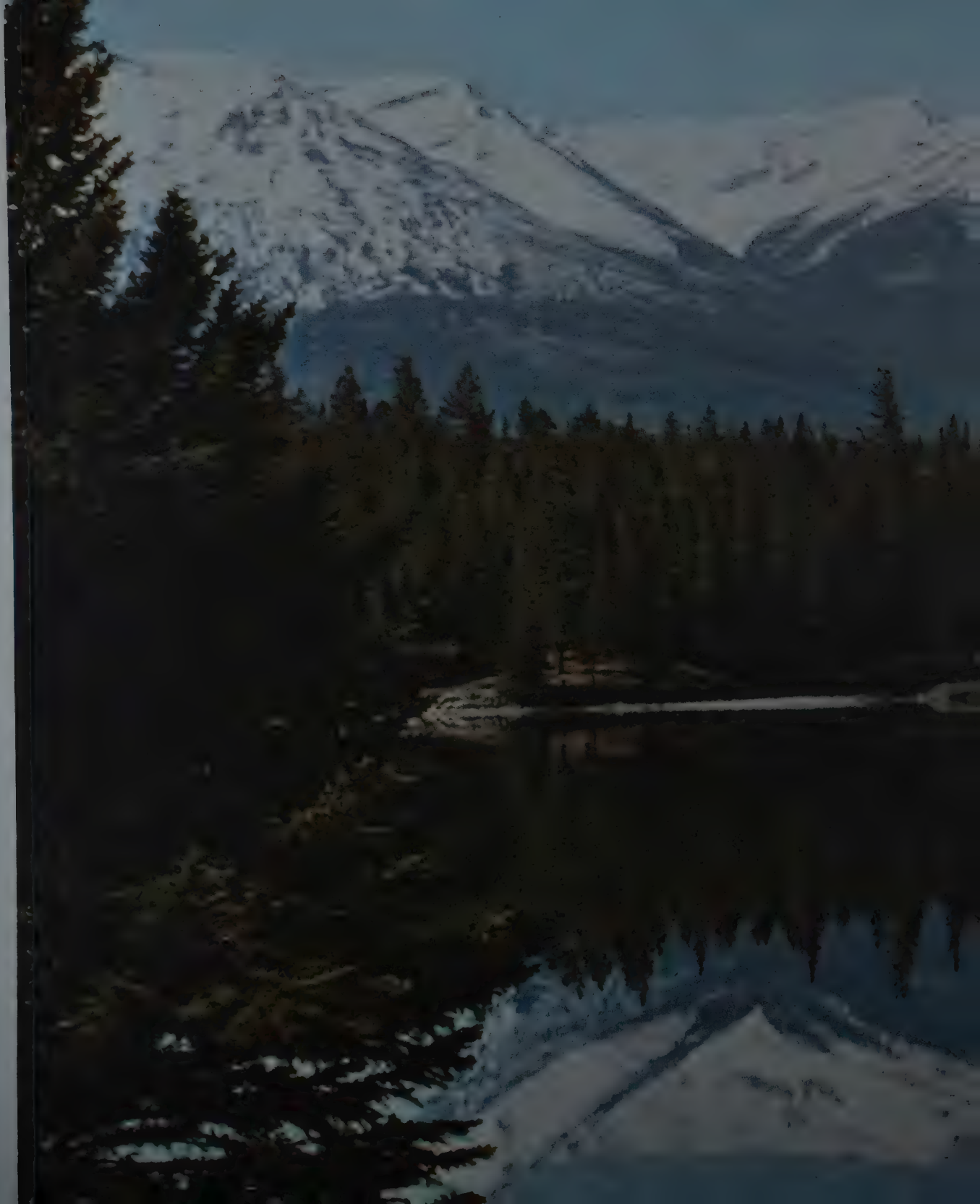
Technicians from the Section operate two mobile laboratories on a continuous basis throughout the province. These units are used to investigate and observe general air pollution levels in the vicinity of gas processing plants and in sour gas field areas. The operators also carry out at each location a survey of the area and all results are then correlated.

Approximately 175 unmanned exposure cylinder stations are maintained in the province and used to monitor the levels of sulphur gases. These monitors are changed monthly and analyzed by the Environmental Health Services laboratory to determine if there are any pollution trends.

Stack sampling surveys are carried out to ensure that major plants observe the air pollution regulations, and operate within approved conditions.

Detailed monitoring is carried out in the cities of Calgary and Edmonton. The levels of a large number of air pollutants are measured, and the data helps determine if the department's policies have been effective with regard to pollutant emission and control. Through these surveys, it is also determined which pollutants may require further control in order to make Alberta's air healthy for everyone, without unnecessarily restricting progress in industry, urbanization or the conveniences of modern living.

A lake, mirroring green forests, snow-capped mountains and a blue sky typifies the aims of the pollution control program: the restoration and preservation of Alberta's clean environment.



SOLID REFUSE DISPOSAL

Most people living in urban areas, after discarding their household garbage in a trashcan, give little thought to what happens to it then beyond knowing that the sanitation department will take it away.

But the control of solid refuse disposal is an integral part in the prevention and control of pollution.

Tin cans, empty packages and food scraps are just a small part of the refuse which is created in a community daily. Commercial wastes from retail and wholesale businesses, old car bodies, industrial wastes, feed lot manure, leaves and grass cuttings all contribute to the three and a half to four pounds of refuse which every person in an urban area creates every day of the year.

In our affluent society this is increasing at a rate which is said to be about four per cent per year. This refuse, if not compacted, has a density of about 300 pounds per cubic yard, with the result that a community must provide collection facilities capable of removing about five cubic yards of uncompacted refuse per person per year. Even with the refuse compacted, as is the common practice, a city of 25,000 persons will have to dispose of 30,000 cubic yards per year, and would use a four-acre pit six feet deep to do so. A city of 400,000 population must dispose of 500,000 cubic yards of refuse, which would create a mound 12 feet high covering 30 acres.

Refuse disposal is not a new concern: at almost every step in the development of civilization the pile of discarded, unwanted material has increased. Some primitive societies handled the problem by periodically moving camp, leaving the rubbish behind. Such a solution is, of course, impossible in a society living in fixed communities.

Attempts not so many years ago to dispose of garbage resulted in the open dump, or nuisance ground. This consisted of a few acres of land usually just out of sight of the community. Across the whole surface were piles of rotting kitchen garbage, old tires, manure, waste building material, car bodies, and paper material partly burned and blowing before the winds to surrounding fields. Often the area was covered by a vile smoke resulting from misguided attempts to clean it up by burning.

Not only was the burning ineffective, but it added to the menace of air pollu-

The open burning dumps, contributing to air pollution and harboring rodents and insects, is becoming a thing of the past as safer and cleaner methods of disposal come into wider use.

Proper disposal of solid refuse is practiced here as garbage is deposited in a sanitary landfill, a long trench wherein refuse is compacted and then covered.

tion. The open dump was extremely unsightly, a waste of land and a continual health hazard through its attraction of rodents and insects.

The rapid growth of even the smaller communities in the province during the past several years has spelt the doom of the open dump. When it ceased to be "something out there in the country" and became "that horrible mess just down the road", and when the increasing amounts of garbage of an affluent society were piled on the already unsightly health menace, new measures were demanded.

Some larger centres have used incinerators for community refuse disposal, but these have not provided a full solution either. The residue of ashes and non-combustibles must be disposed of, and incinerators also contributed to air pollution.

Other factors contributing to the difficulties many communities are experiencing in the disposing of garbage are the problems of securing land adjacent to communities due to competition from other potential users, and the high cost of acceptable alternative disposal methods, such as incinerators constructed to avoid air pollution.

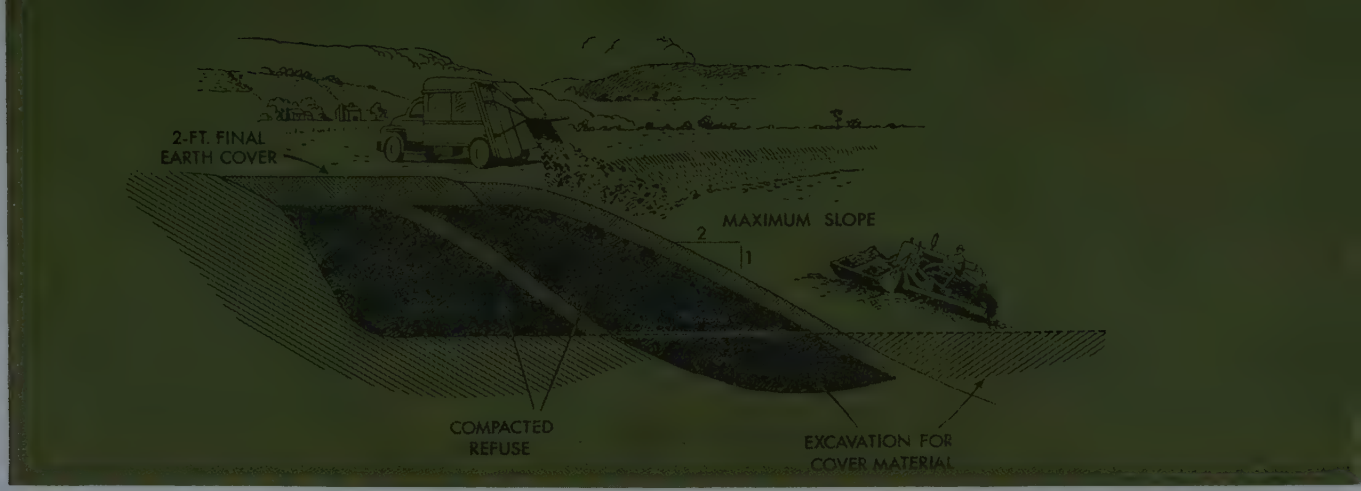
Varied methods of solid refuse disposal are practiced in different parts of the world. These include composting, disposal to natural bodies of water, on site incineration by households and apartments, on site grinding and discharge to sewers, and feeding to animals. All of these have limited practicability in Alberta.

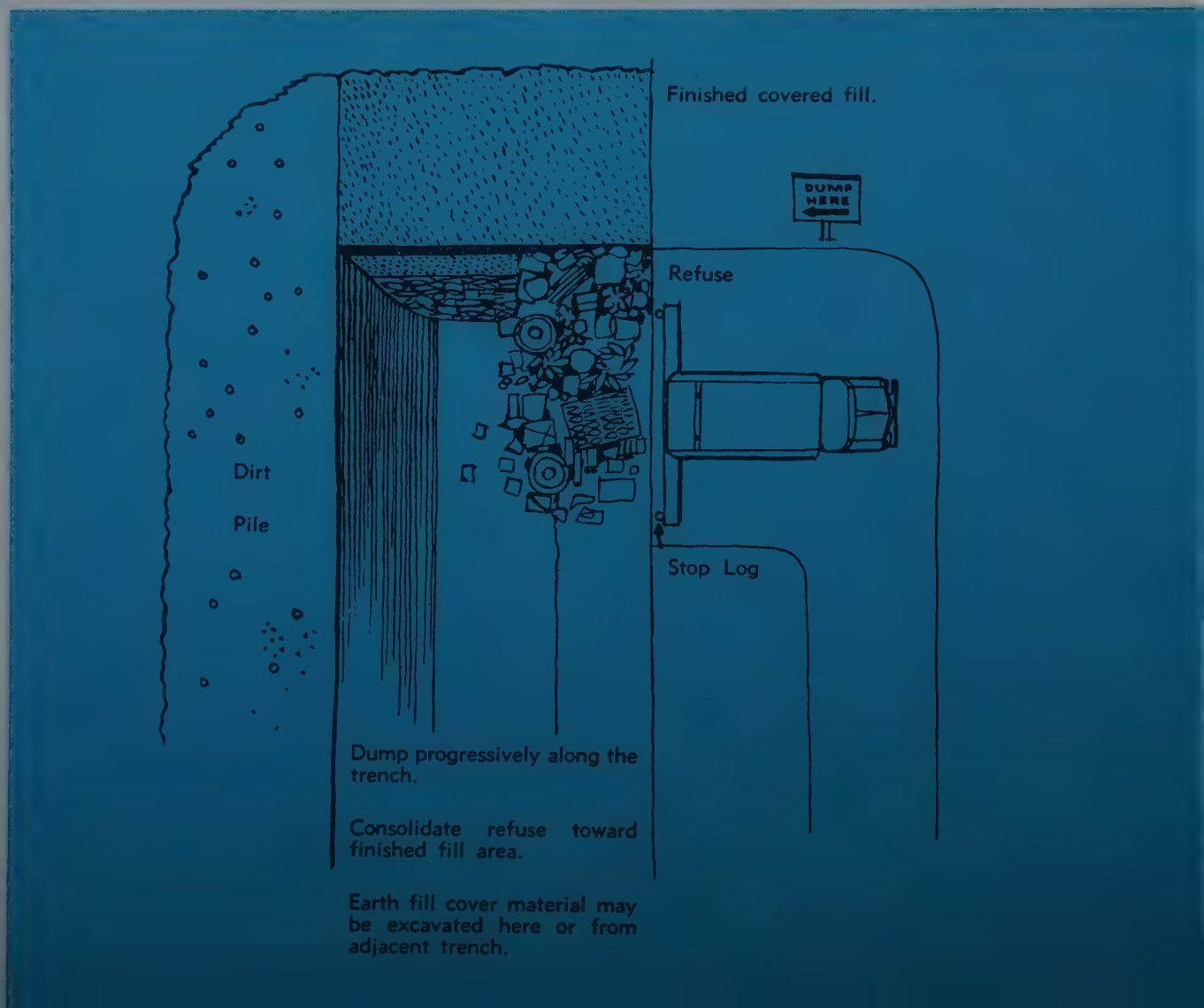
By far the greatest quantities of solid refuse created in communities are disposed of in landfills. There is little, if any relationship between a modern, properly operated landfill and the old open dump.

There are two types of landfill which are now accepted for use in Alberta. Both are governed by the Provincial Board of Health Regulations Respecting Refuse Disposal Systems, and administered by the Public Health Inspection Section.

The first type is the true sanitary landfill required for communities where the population exceeds 5,000. This a fully planned operation on a carefully selected site, and must have the approval of the Provincial Board of Health. It is usually required that the site be at least 1,500 feet from any dwelling.

In this sanitary landfill, refuse is deposited in a prepared trench. It is then





compacted — reduced in volume by driving a machine such as a front-end loader back and forth over it. Soil cover is applied daily where a population over 20,000 is served and three times weekly when the population is less. The compacted refuse may not be deeper than two feet. Successive layers of refuse and soil are then added on top of each other until the landfill is completed. The last application consists of at least two feet of soil.

Design and operating standards for sanitary landfills have been published by the Board.

There are several advantages to a properly situated, planned and operated sanitary landfill: solid refuse may be disposed of in a method which limits danger to health, and usually does not give cause for complaints and the cost of the disposal facility is usually low in comparison with other methods. With proper planning, otherwise unuseable land may be made useful for car parking, recreational facilities, or other purposes.

Although a sanitary landfill is an ideal way for disposal of refuse it may not be practical for a small community. In Alberta a community having a population of less than 5,000 is permitted to use a modified landfill. It is similar to a sanitary landfill in that it provides a trench to receive refuse. From time to time this refuse will be compacted and covered with soil, depending on the size of the community— at least monthly in those just under 5,000 population down to once or twice a year where only a few hundred persons are served. Burning is not prohibited but will only be permitted where and when it will not create offensive smoke.

Municipalities proposing to use modified landfills are also required to plan the operation although the requirements are not as rigid as for a sanitary landfill.

There are many special problems in solid refuse disposal. Certain materials, including many industrial wastes, must receive special treatment. It is not possible to set down general provisions for these, since each must be considered separately and instructions given. One particular problem which has come to the fore in recent years is the disposal of old car bodies. Every year an increasing number of automobiles are removed from service. There is a market for the steel in these old carcasses but unfortunately it must be prepared to be acceptable to the steel industry. Non-ferrous material must be removed and the steel either shredded or compressed to a small block. This creates a problem of economics, as only under ideal conditions does the price of the scrap steel leave any margin above the cost of the processing required. There is little left to pay for transportation of the old car body over any great distance.

In some places old car bodies are permitted to accumulate until some change takes place which will enhance the economics of handling the scrap steel. In other instances the old car bodies are collected on a portion of the landfill site and periodically crushed and placed in the landfill. These remedies can only be considered temporary solutions.

The regulations covering refuse disposal systems make provision for supervision by provincial and local health authorities. The permission of the Provincial Board of Health must be obtained before a new refuse disposal system can be established, and this is given only after pollution experts have scrutinized the plans.

The views and opinions of the Health Unit or City Health Department of the area concerned are also considered and

Because it may not be economical to process scrap metal, old car bodies are often piled up and left in an open place. Disposal of this form of solid refuse continues to present problems.

they are required to provide public health supervision once established.

The disposal of refuse is largely a matter for municipal governments, but there are areas where individual citizens should assume responsibility, especially in the first stage of disposal. The provision of an adequate number of garbage containers with lids is essential, and these should be maintained and cleaned periodically.

Persons hauling their own refuse to landfills should dispose of it in the trenches in accordance with posted directions. This will help keep the landfill operating in an orderly fashion. Fires should not be started unless so directed by the authority in charge, and persons hauling their own refuse should take care that material does not blow or fall off along the road. Under no circumstances should refuse be dumped in road ditches or fields.

Society today creates tremendous amounts of waste material. The disposal of this material for the protection of health in an inoffensive manner will no doubt continue to pose problems, but an informed and aware public will always be able to assist officials responsible for this task.

WATER AND SEWERAGE SYSTEMS

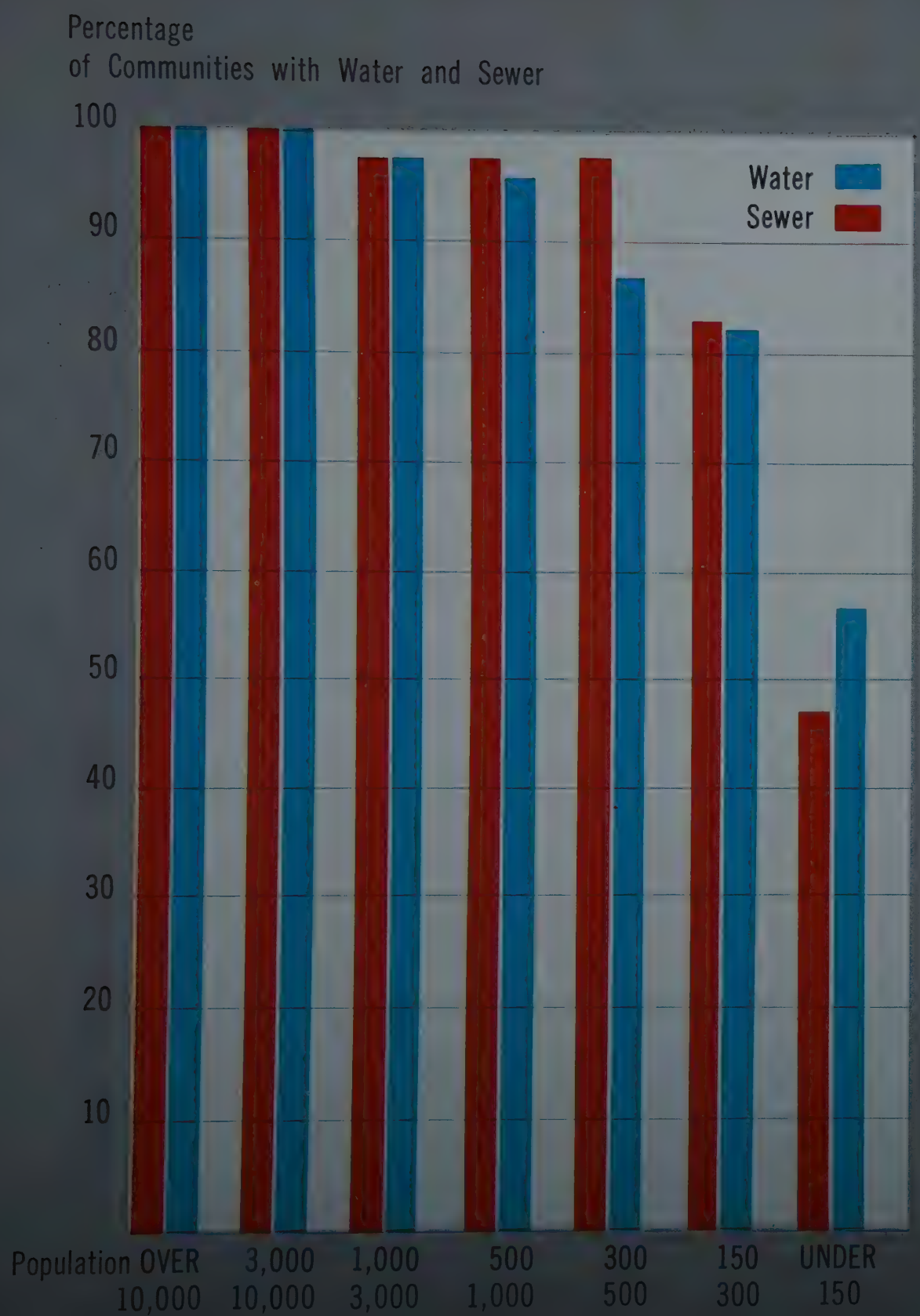
Any attempts at controlling water pollution would be almost futile if control were not exercised over the quality of sewage discharged into Alberta's river systems.

For this reason, all sewage collection and treatment facilities as well as water supply and distribution systems are reviewed, during their design, construction and operation, by the Municipal Engineering Section.

Since 1945, the number of water and sewerage systems in Alberta has increased twelvefold. At the end of 1969, there were 278 communities served with water and/or sewerage systems; 242 had water systems, 18 of which did not have sewerage systems; and 246 had sewerage systems, 22 of which did not have waterworks systems. All cities and towns with a population of over 3,000 had both water and sewerage systems, while 98 per cent of those with populations between 1,000 and 3,000 had both systems.

Based on 1969 population figures, 74.4 per cent of the province's residents are serviced by a municipal water system and 74.6 per cent are serviced by a municipal sewerage system.

The large number of water and sewerage systems in the province can be attributed to the provincial government



Top: *This short-detention sewage pond allows solids to settle, and greasy substances to rise to the top, from where they are then removed.* Bottom: *The resulting waste water is aerated for a further degree of treatment.*

which, since about 1950, has supported municipal projects by purchasing debentures for the construction of these systems.

The utilization of sewage lagoons has helped tremendously in keeping the cost of the necessary treatment down. These lagoons utilize a natural process whereby sunlight provides the energy to promote the growth of algae, which produces oxygen. The oxygen is then used by bacteria which break down organic wastes. This in turn produces carbon dioxide which is utilized by the algae, thus completing a continuing cycle.

Lagoons were researched during 1958 and 1964 by the Environmental Health Services Division. The result was the widespread use of lagoon systems for treatment of municipal and industrial sewage. The method has benefited numerous communities throughout the world by providing a highly efficient, inexpensive method of sewage treatment.

Entering the 1970's, 98 per cent of the communities with sewerage systems had sewage treatment facilities to prevent pollution of Alberta's rivers. In 1968 the Provincial Board of Health required that a minimum degree of sewage treatment (the removal of solids) be provided by all municipalities serviced with sewage collection systems.

Sewage flows through this tank and comes into contact with air pumped in from the bottom. Through this aeration process, sewage is biologically treated to prevent it from polluting surface waters.

Municipalities must submit engineering reports for proposed sewerage and waterworks projects to the Section for review. If the report is acceptable, it is then recommended to the Provincial Board of Health for approval. This procedure ensures that the proposed works may be constructed and operated with safety to the public health.

The Municipal Engineering Section is responsible for ensuring that all systems are effectively operated and maintained. To do this, inspections are conducted throughout the year, and where deficiencies in water treatment, water distribution, sewage collection or sewage treatment are noted, municipalities are required to correct the problem.

With the ever increasing population and industrial discharges into municipal systems, the sewage treatment plants and the receiving body of water are continually being reviewed, and the required degree of treatment upgraded to maintain the rivers in a useable condition.

To ensure that trained operators are available for the province's sewerage and water systems, annual schools, as well as correspondence courses, are conducted. Operators are certified, depending on their education, experience, attendance at oper-

Top: *A paddle wheel in the housing at the right of the picture continuously moves sewage through an oblong ditch to provide a greater measure of oxydation and thereby better treatment of the sewage.* Bottom: *Landscaped grounds do much to ensure that sewage treatment lagoons do not become an eyesore in the community.*

ator's schools and completion of correspondence courses.

It is expected that through certification, a higher degree of maintenance and operation will come about. Treatment of sewage to prevent pollution and the production of clear, bacteria-free drinking water requires definite knowledge on behalf of the operators.

Plans for public and semi-public swimming pools are reviewed by the Section before approval is recommended to the Provincial Board of Health. Upon completion, an initial inspection is conducted. There are now 96 public and 142 semi-public pools in the province.

Fluoridation of municipal water supplies is supervised, and each municipality maintains a daily record of fluoridation and forwards these for checking and reviewing.

The Municipal Engineering Section provides technical assistance to local health authorities and publishes helpful material to ensure the safety of public drinking waters, directly by supervising treatment before it goes into the water system, and indirectly by making certain that raw or insufficiently treated sewage does not enter the many miles of waterways.

PLUMBING INSPECTION

Although most of Alberta's urban areas are equipped with sewage collection and treatment facilities, private sewage disposal systems still exist, especially in the rural areas. These could, if not properly built and maintained, cause water pollution through the discharge of insufficiently treated or raw sewage.

Private systems may use two methods of sewage disposal: ground absorption or a lagoon.

The ground absorption method requires the installation of a septic tank, which separates the sewage so that liquid only is discharged into the ground. This liquid is distributed through a system of pipes into the upper layers of the soil, where bacteria act on it to make it safe. It is customary to follow this "field tile disposal system" with a cesspool to maintain control of any effluent which passes through the field.

The sewage lagoon method of disposal consists of a large holding pond, designed to retain sewage for at least one year. It relies on the combined action of bacteria and algae to accomplish treatment of the sewage, which is released periodically, and only when it will least affect the drainage course receiving it.

In many cases it is necessary to collect sewage in tight tanks to prevent pollution. The sewage from the tanks is then hauled away for disposal in modified landfills or other locations where it can do no harm.

Buildings which discharge sanitary sewage to a private system are required to have the storm water drainage completely separate from the sanitary sewerage system to prevent flooding of the system and the creation of a pollution problem.

The regulations governing private systems are administered by the Plumbing Inspection Section. Their jurisdiction also extends to trailer coach parks and holiday trailer parks.

Legislation as it exists is such that pollution of water supplies, as well as sources of potable water, is almost impossible from the point of view of waste disposal from a plumbing system, whether it be discharged to a municipal or private sewage disposal system.

LABORATORY

Analysis of waste compounds discharged into air or water to ensure they comply with permitted concentrations is carried out by the Environmental Health Services laboratory.

The lab receives test samples from the Air Pollution Control, Water Pollution Control and Municipal Engineering Sections of the division, and analyzes these for compounds which may present a pollution problem.

Monitoring devices from approximately 175 stations across the province which are able to pick up poisonous gases from the air are checked continuously, and the concentration of these gases is determined.

The lab also tests river water samples to ensure that pollution will not occur. In this respect, an important test is to determine the oxygen concentration which a river requires for the oxidation of specific wastes discharged into it. Analysis for poisonous chemical elements or compounds which may be contained in industrial effluents enables the controlling section to either disallow the discharge of such effluents, or keep the concentration below a detrimental level.

Another part of the laboratory work is the testing of pesticides and herbicides in water, due to a growing concern about the chemical stability of some of these organic compounds and their detrimental effects.

In 1969, a total of 6,062 samples were analyzed and 21,574 individual tests performed. The detection limits for chemical compounds in water or air are in the range of one part per million to even one tenth of a part per billion by weight, depending on the compound.

Modern analytical methods and complex instruments are applied in the analysis work to detect very low concentrations, thereby providing an invaluable service in the cause of prevention and control of pollution in Alberta.

The safety of persons, and the conservation of Alberta's environment are the primary objectives of the pollution control work being carried out by the Division of Environmental Health Services to ensure that scenes like this will still be available to future generations.